REMARKS

Amendments

Claim 1 has been amended to recite that the overheat protection device further comprises a resistor and that the relationship between the resistance of the variable resistive element and the resistor being $R/P_L > 10$ and $R/P_H < 1/10$. Basis is found in original claim 5 and in paragraph [0029] of the specification. These amendments have been made in the interest of rapid prosecution and without prejudice to Applicants' right to prosecute claims of similar or different scope to the unamended claims in one or more continuation applications.

The Rejection Under 35 USC § 103(a)

Applicants respectfully traverse the rejection of claims 1, 2, 4-7, 10, and 11 under 35 USC § 103(a) as unpatentable over Atsushi (Japanese Publication No. 2000-152516) in view of Sato (U.S. Patent No. 6,700,766) and further in view of Myong et al. (U.S. Patent No. 6,356,424), insofar as the rejection is applicable to the amended claims.

The present claims are directed to an overheat protection device comprising a variable resistive element which is a polymer PTC element that changes resistance as a function of temperature. The device further comprises a switching element which controls a current flowing through an electrical system depending on an applied voltage thereto, and a resistor. The electrical system comprises a secondary battery, i.e. a battery that is rechargeable and thus requires overcharge protection. The variable resistive element is located on and thermally combined with a certain position of the electrical system and interrupts the current flowing through the electrical system by changing the applied voltage to the switching element when the certain position comes to be under a high temperature condition. As previously stated, in contrast to conventional systems in which detection of a temperature anomaly and the restriction of current once the temperature anomaly is detected is done by the variable resistive element only, the present claims recite a device in which the variable resistive element is used in combination with the switching element and the resistor. The variable resistive element changes the applied voltage to the switching element and interrupts the current flowing through the system. The relationship between the resistance of the variable resistive element and the resistor is $R/P_L > 10$ and $R/P_H < 1/10$, where P_H and P_L are the resistances of the variable resistive in a high temperature state and in a low temperature statue, respectively. It is thus possible to

effectively prevent the overheating by promptly detecting the temperature anomaly of the electrical system while the decrease in power efficiency of the electrical system is low. In one embodiment, a plurality of variable resistive elements are used and can be positioned on various portions of the electrical system, e.g. on the secondary battery. Because polymer PTC elements increase significantly, i.e. several decades, in resistance over a very narrow temperature range, it is possible to provide switching over a narrow range.

Atsushi discloses a battery pack protection device in which a resistor (21A) is connected in series with a thermistor (21B), and the combination is connected in parallel with a battery. A switching circuit including a FET is connected in series with battery. As the Examiner states, Atsushi does not teach the presence of a polymer PTC element. Neither does Atsushi teach that the relationship between the resistor and the variable resistor should be $R/P_L > 10$ and $R/P_H < 1/10$.

The deficiencies of Atsushi are not resolved by the addition of Sato. Sato discloses a protection circuit including a polymer PTC device and a diode connected in series and in thermal proximity with each other. As with Atsushi, there is no teaching or suggestion that the relationship between the resistor and the variable resistor should be $R/P_L > 10$ and $R/P_H < 1/10$.

The deficiencies of Atsushi and Sato are not resolved by the addition of Myong et al. Myong discloses an electrical protection system in which (a) a PTC device which can be a polymer PTC device is thermally coupled with a resistive device and (b) a relay coil is coupled with relay contacts, the series combination of (a) and (b) resulting in a control element. There is no disclosure or suggestion that the relationship between the resistor and the variable resistor should be $R/P_L > 10$ and $R/P_H < 1/10$ in order to achieve satisfactory performance. Thus, Applicants believe that it would not be obvious to one of ordinary skill in the art who read the cited documents to make an overheat protection device as recited by the present claims.

Conclusion

It is believed that this application is now in condition for allowance and such action at an early date is earnestly requested. If, however, there are any outstanding issues which can be usefully discussed by telephone, the Examiner is asked to call the undersigned.

Respectfully submitted,

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